



Computerized Manufacturing and Machining Technology

Program of Studies
2015-2016



Office of Career and Technical Education
Kentucky Department of Education



Computerized Manufacturing and Machining Technology

Program Area Course Title	Post- Secondary Connection	Valid Course Code	Recommended Grade Level				Recommended Credit
			9	10	11	12	
Advanced Dimensioning and Measurement	CAD 240	470924		X	X	X	1
Applied Machining I	CMM 120	470911	X	X	X	X	1
Applied Machining II	CMM 122	470912	X	X	X	X	1
Blueprint Reading for Machinists	BRX 112	470921		X	X	X	1
CAD/CAM/CNC	CMM 132	470925			X	X	1
Conversational Editing and Subroutines	CMM 2302	470927		X	X	X	1
Co-op (Machine Tool)	CMM 299	470929			X	X	1
Fundamentals of Machine Tools - A	CMM 110	470913	X	X	X	X	1
Fundamentals of Machine Tools - B	CMM 112	470914	X	X	X	X	1
Interdisciplinary Geometry and Compute Aided Drafting (CAD)		480114	X	X	X	X	1
Internship (Machine Tool)	CMM 298	470932			X	X	1 - 3
Intermediate Computer Aided Drafting	CAD 200	480112	X	X	X	X	1
Introduction to Computer Aided Drafting	CAD 100	480110	X	X	X	X	1
Introduction to Conversational Programming	CMM 2301	470926		X	X	X	1
Introduction to Engineering Design (<i>PLTW</i>)		219901	X	X	X	X	1
Manual Programming	CMM 130	470915	X	X	X	X	1
Mechanical Blueprint Reading	BRX 210	470922			X	X	.5
Metrology/Control Charts	CMM 118	470928		X	X	X	.5
Special Problems (CMM)	IEX 291	470979		X	X	X	1
Technical Mathematics (<i>must be taught for dual credit</i>)	MAT 116	270643		X	X	X	1

Last revised May 15, 2015

Overview of Computerized Manufacturing and Machining Technology

Purpose

The vision of Computerized Manufacturing and Machining Technology is to promote safety and performance standards, enhance leadership skills, and provide relevant curriculum vital to the education of all students.

The Computerized Manufacturing and Machining Technology program prepares students by engaging them with scientific, mathematical, and critical thinking skills through the classroom and lab/shop training.

Computerized Manufacturing and Machining Technology will:

- Operate as the venue for nationally recognized industry standard training.
- Provide a critical link in school to employment or postsecondary education.
- Develop stronger relationships with the community in terms of mutual advocacy, cooperative field experiences, employment placement, and support for relevant student organizations and competitions.
- Represent an important component in the education of all students.
- Require and promote critical thinking and problem solving.
- Offer an up to date curriculum based on standards that adapts to changes in the industry.
- Integrate academic skills to insure that students develop written and verbal communications skills, computational skills, and scientific/math problem-solving skills.

Career Pathways

- *Machinist Technician*
- *Machinist Operator*
- *Computer Numerical Control (CNC) Programmer*
- *Computer Numerical Control (CNC) Operator*
- *Computerized Manufacturing & Machining Manufacturing TRACK*

Standards Based Curriculum

The Computerized Manufacturing and Machining Technology Curriculum is composed of standards-based competencies. All Computerized Manufacturing and Machining Technology programs incorporate industry and common core standards thus increasing the student's qualifications toward successful employment.

Alignment of the Computerized Manufacturing and Machining Technology curriculum with nationally recognized industry standards and the common core standards provides optimal preparation for students to acquire an industry certification.

Communities understand that this preparation provides better career opportunities for students and the demands of today's workforce for the 21st century.

Kentucky Occupational Skill Standards

The Kentucky Occupational Skill Standards are the performance specifications that identify the knowledge, skills, and abilities an individual needs to succeed in the workplace. Identifying the

necessary skills is critical to preparing students for entry into employment or postsecondary education. These standards describe the necessary occupational, academic, and employability skills needed to enter the workforce or post-secondary education in specific career areas. There is an ongoing effort to continue to refine these standards by which exemplary Career and Technical Education Programs are evaluated and certified. This helps insure that curriculum meets industry specifications.

2014 – 2015 Valid Industry Certification and KOSSA List

Work Based Learning

Cooperative experience, internships, shadowing and mentoring opportunities provide depth and breadth of learning in the instructional program and allow students to apply the concepts learned in the classroom. The Work Based Learning Manual is available on the KDE webpage: www.education.ky.gov.

Student Organizations and Competitions

Participation in SkillsUSA competitions provides a vehicle for students to employ higher order thinking skills, interact with high-level industry representatives and enhance leadership skills through participation in regional, state and national competitive events and activities.

COMPUTERIZED MANUFACTURING & MACHINING

CAREER PATHWAYS

2015-2016

MACHINIST TECHNICIAN

CIP 48.0503.01

PATHWAY DESCRIPTION: Machinist Technicians set up and operate a variety of machine tools, such as lathes, milling machines, and grinders, to produce precision metal parts, instruments, and tools. These tools are either manually controlled or computer-numerically controlled (CNC). Machinist Technicians must be able to read blueprints, align and adjust cutting tools and inspect the finished product to meet customer specifications.

BEST PRACTICE CORE

*Foundational Skills Necessary for Career-Ready Measure:
(KOSSA/Industry Certification)*

*Complete (3) **THREE CREDITS:***

- 470921 Blueprint Reading for Machinists
- 470913 Fundamentals of Machine Tools-A
- 470914 Fundamentals of Machine Tools-B

*Choose (1) **ONE CREDIT** from the following:*

- 470911 Applied Machining I
- 470912 Applied Machining II
- 470915 Manual Programming
- 480110 Introduction to Computer Aided Drafting
- 470922 Mechanical Blueprint Reading*
- 470928 Metrology/Control Charts*
- 219901 Introduction to Engineering Design (**PLTW**)
- 470929 Co-op (Machine Tool) OR 470932 Internship (Machine Tool)

Note: (PLTW) courses require an agreement between Project Lead the Way and the Local School District.

Note: (*) Indicates half-credit (.5) course

EXAMPLE ILP-RELATED CAREER TITLES

Machine Operator
Machinist
Maintenance
Machinist
CNC Machine
Operator
CNC Programmer
Quality Control
Manager
Mechanical Engineer
Engineer Technician
Industrial Engineer

COMPUTERIZED MANUFACTURING & MACHINING

CAREER PATHWAYS

2015-2016

MACHINIST OPERATOR

CIP 48.0503.02

PATHWAY DESCRIPTION: Machine operators are responsible for producing precision machined parts. They measure parts with precision tools in order to make sure certain parts meet pre-determined quality and cosmetic standards. When parts have passed inspection, the parts go on to the next phase of production. Machine operators are expected to meet production quotas. The level of documentation required varies, depending on the degree of precision needed for the finished product. Machine operators also need to keep track of the number of units that are scrapped due to various errors.

BEST PRACTICE CORE

EXAMPLE ILP-RELATED CAREER TITLES

*Foundational Skills Necessary for Career-Ready Measure:
(KOSSA/Industry Certification)*

*Complete (3) **THREE CREDITS:***

- 470913 Fundamentals of Machine Tools-A
- 470914 Fundamentals of Machine Tools-B
- 470911 Applied Machining - I

*Choose (1) **ONE CREDIT** from the following:*

- 470921 Blueprint Reading for Machinists
- 470912 Applied Machining II
- 470915 Manual Programming
- 480110 Introduction to Computer Aided Drafting
- 470922 Mechanical Blueprint Reading*
- 470928 Metrology/Control Charts*
- 219901 Introduction to Engineering Design (**PLTW**)
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Note: (PLTW) courses require an agreement between
Project Lead the Way and the Local School District.

Note: (*) Indicates half-credit (.5) course

Machinist Technician

Machinist

Maintenance
Machinist

CNC Machine
Operator

CNC Programmer

Quality Control
Manager

Mechanical Engineer

Engineer Technician

Industrial Engineer

COMPUTERIZED MANUFACTURING & MACHINING

CAREER PATHWAYS

2015-2016

COMPUTER NUMERICAL CONTROL (CNC) PROGRAMMER

CIP 48.0503.03

PATHWAY DESCRIPTION: CNC programmers develop and run programs which direct the CNC machines to cut and shape metal or plastic for such things as airplanes, automobiles and other industrial machines. CNC programmers use blueprints and 3-dimensional computer designs to create the programs which result in precisely cut products. Attention to detail and the ability to follow precise directions are vital to a CNC programmer as well as the ability to work independently.

BEST PRACTICE CORE

EXAMPLE ILP-RELATED CAREER TITLES

*Foundational Skills Necessary for Career-Ready Measure:
(KOSSA/Industry Certification)*

*Complete (4) **FOUR OR MORE CREDITS:***

- 470921 Blueprint Reading for Machinists
- 480110 Introduction to Computer Aided Drafting
- 470913 Fundamentals of Machine Tools-A
- 470915 Manual Programming
- 470925 CAD/CAM/CNC
- 470929 Co-op (Machine Tool) OR 470932 Internship (Machine Tool)

Machine Operator
Machinist Technician
Machinist
Maintenance
Machinist
CNC Machine
Operator
CNC Programmer
Quality Control
Manager
Mechanical Engineer
Engineer Technician
Industrial Engineer

COMPUTERIZED MANUFACTURING & MACHINING CAREER PATHWAYS 2015-2016

COMPUTER NUMERICAL CONTROL (CNC) OPERATOR CIP 48.-0503.04

PATHWAY DESCRIPTION: CNC operators monitor and operate CNC (computer numerically controlled) machines to cut metal and plastic parts for the manufacturing industry. They select and download CNC programs and perform test operations to ensure the product is made to specifications. The CNC operator may be responsible for selecting and setting all tools required for producing the final precision part to customer specifications.

BEST PRACTICE CORE

*Foundational Skills Necessary for Career-Ready Measure:
(KOSSA/Industry Certification)*

*Complete (4) **FOUR CREDITS:***

- 470913 Fundamentals of Machine Tools-A
- 470914 Fundamentals of Machine Tools-B
- 470915 Manual Programming
- 470925 CAD/CAM/CNC
- 470929 Co-op (Machine Tool) OR 470932 Internship (Machine Tool)

EXAMPLE ILP-RELATED CAREER TITLES

Machine Operator
Machinist Technician
Machinist
Maintenance Machinist
CNC Programmer
Quality Control
Manager
Mechanical Engineer
Engineer Technician
Industrial Engineer

COMPUTERIZED MANUFACTURING & MACHINING CAREER PATHWAYS 2015-2016

COMPUTERIZED MANUFACTURING & MACHINING MANUFACTURING TRACK CIP 48.0500.99

PATHWAY DESCRIPTION: The Computerized Manufacturing & Machining TRACK is designed as a pre-apprenticeship pathway for technical students to enter industry. Through the collaboration of local industry, technical school, program instructor, student and parents, a pre-apprenticeship agreement is signed. Local industry chooses 4 courses related to the required skills that will prepare the student to enter a four year apprenticeship sponsored by the company. Upon graduation the student under the discretion of the company; may be awarded reduced apprenticeship time or start at a higher wage.

BEST PRACTICE CORE

*Foundational Skills Necessary for Career-Ready Measure:
(KOSSA/Industry Certification)*

*Complete (4) **FOUR CREDITS:***

- (4)- Core courses chosen from the CMM valid course list by the company sponsoring a State Registered Apprenticeship.

EXAMPLE ILP-RELATED CAREER TITLES

Machine Operator
Machinist Technician
Machinist
Maintenance
Machinist
CNC Machine
Operator
CNC Programmer
Quality Control
Manager
Mechanical Engineer
Engineer Technician
Industrial Engineer


The Tech Ready Apprentices for Careers in Kentucky (*TRACK*) pre-apprenticeship program is a partnership between The Kentucky Department of Education's Office of Career and Technical Education and The Kentucky Labor Cabinet to provide pre-apprenticeship career pathway opportunities into registered apprenticeship programs to secondary students. This is a business and industry driven program to create a pipeline for students to enter post-secondary apprenticeship training.

Upon successful completion, the student will be awarded an industry certification by the employer or training organization through The Kentucky Labor Cabinet and all on-the-job hours worked will be counted towards the apprenticeship, if applicable. The certification will also count towards the local school district's college and career ready accountability index.

The specifics of the TRACK program vary and interested parties will need to confer with the Office of Career and Technical Education for the implementation process. There are no costs involved except wages for the student

employee. The employer must have a registered apprenticeship program with The Kentucky Labor Cabinet. For more information, please refer to: <http://education.ky.gov/CTE/cter/Pages/TRACK.aspx>. As career pathways continue to expand, the ultimate rationale is that if an employer is willing to implement a Registered Apprenticeship program, a pipeline at the secondary level can be developed utilizing the TRACK program.

COMPLEMENTARY OR ADVANCED COURSEWORK BEYOND CMM PATHWAY(s)
Upon completion of a pathway, additional coursework to enhance student learning is encouraged. Credits earned in Advanced or Complementary Coursework “Beyond the Pathway” may not be substituted for pathway courses in order to achieve Preparatory or Completer status.
<ul style="list-style-type: none">• 470924 Advanced Dimensioning and Measurement
<ul style="list-style-type: none">• 470927 Conversational Editing and Subroutines
<ul style="list-style-type: none">• 480114 Interdisciplinary Geometry and Computer Aided Drafting (CAD)
<ul style="list-style-type: none">• 480112 Intermediate Computer Aided Drafting
<ul style="list-style-type: none">• 470926 Introduction to Conversational Programming
<ul style="list-style-type: none">• 470979 Special Problems (CMM)
<ul style="list-style-type: none">• 270643 Technical Mathematics (<i>must be taught for dual credit</i>)
<ul style="list-style-type: none">• Career Options
<ul style="list-style-type: none">• JAG Courses

KENTUCKY CAREER PATHWAY/PROGRAM OF STUDY TEMPLATE										
COLLEGE/UNIVERSITY:		Kentucky College/State University				CLUSTER:		Manufacturing		
HIGH SCHOOL (S):		Career Tech High School				PATHWAY:		Machinist/Manufacturing Mgr		
						PROGRAM:		Computerized Manufacturing and Machining		
SECONDARY	GRADE	ENGLISH	MATH	SCIENCE	SOCIAL STUDIES	REQUIRED COURSES RECOMMENDED ELECTIVE COURSES OTHER ELECTIVE COURSES CAREER AND TECHNICAL EDUCATION COURSES			CREDENTIAL CERTIFICATE DIPLOMA DEGREE	SAMPLE OCCUPATIONS
	9	English I	Algebra I	Earth Science	Economics	History and Appreciation of Visual and Performing Arts	*Intro to Technical Occupations	Computer Applications		
	10	English II	Geometry	Biology	U.S. History	BRX 112-Blueprint Reading	MTT 110 Fundamentals of Machine Tools-A	MTT 112 Fundamentals of Machine Tools-B		
	11	English III	Algebra II	Physical Science	World Geography	CAD 100 Intro to CAD	MTT 120 Applied Machining I	MTT 122 Applied Machining II	Machinist Technician	
	12	English IV	Trigonometry	Chemistry	Health & PE	CMM 130 Manual Programming	CMM 132 CAD/CAM/CNC	MTT 199 Cooperative Education	Certification / TRACK Pre-Apprenticeship/ KOSSAHS	Machine Operator/CNC Programmer
	Take ACT - Apply for admission to Morehead State University					*Courses to be developed				
POSTSECONDARY	Year 13	Writing I & II	Calculus I	Humanities	Computer Competence - IET 110	CAD 200 Intermediate CAD	CMM 2301 Editing and Sub-routines	CMM 2302 Editing and Sub-routines		
	Year 14	Oral Communications CMSP 108	IET 320 Proj Mgt	IET 303 Materials Science	Soc. & Behav. Sci. (Econ 101 or 201)	CAD 240 Advanced Dimension	CAD 250 Advanced CAD	IEX-293 Special Problems	Associate in Applied Science	Manufacturing Supervisor or Technician
	Year 15		Natural and Mathematical Sci. (Phys 201,201A)	IET 330 Industrial Design	Social Sciences (IET 300 Tech.& Society)	ITMT 107 Plastics & 306 Mold Design	IET 319 Quality Control	IET 327 Applied Industrial Management		
	Year 16	IET 499C Senior Project	Math 353 Statistics	IET 422 Industrial Safety Stds.	IET 488 Flexible Manu. Engineering	IET 317 Time and Motion - ITMT 307 Metallurgy	IET 419 Total Quality Imp.	IET 320 Sup. Pract. & ITMT 470 Auto. Mfg. Sys.	Bachelor's Degree	Manufacturing Manager
 CCTI <small>COLLEGE AND CAREER TRANSITIONS INITIATIVE</small> Funded by the U. S. Department of Education (V05B020001) Revised Jan. 2005 October, 2006-CTE Kentucky		Required Courses								
		Recommended Elective Courses								
		Other Elective Courses								
		Career and Technical Education Courses								
		Credit-Based Transition Programs (e.g. Dual/Concurrent Enrollment, Articulated Courses, 2+2+2) (♦ = High School to Comm. College) (* = Com. College to 4-Yr Institution) (# = Opportunity to test out)								
		Mandatory Assessments, Advising, and Additional Preparation								
		Note: Categories of courses (e.g. Required, Recommended Electives, other Electives and career and Technical Education) apply to both secondary and postsecondary levels.								

Advanced Dimensioning and Measurement

Valid Course Code: 470924

Course Description: Presents an in-depth study of advanced industrial dimensioning principles, tolerances, fits, and A.N.S.I. standards. Exploration of the shape and geometric characteristics of parts through geometric tolerance.

Prerequisites: Fundamentals of Machine Tool A - 470913

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Define terms and principles used in advanced dimensioning.
5. Apply using drawing practices, tolerance dimensioning on mating parts.
6. Explain and work with A.N.S.I. standards.
7. Demonstrate surface texture symbols and surface finish.
8. Compare conventional tolerance with Geometric Dimensioning and Tolerance.
9. Establish a basic understanding of Geometric Dimensioning and Tolerance.
10. Analyze specific graphic designs and determine the proper location for dimensions.
11. Define terms and principles relating to Dimensional Metrology.
12. Demonstrate a working knowledge of basic hand held measuring instruments.
13. Measure with basic hand-held measuring instruments.
14. Explain the relationship of precision measurement to manufacturing and design.
15. Demonstrate a working understanding of one-tenth of an inch or one-thousandth of an inch.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CAD 240
- CTSO - SkillsUSA
- KOSSA

Applied Machining - I

Valid Course Code: 470911

<p>Course Description: Consists of intermediate level skills using machining machines and surface grinders. It will include the selection of grinding wheels. Applications in milling, lathe, bench work, and utilizing gauge blocks and the sine bar are covered in this course. Surface grinding and abrasives are introduced and properties of metals are discussed.</p> <p><i>Prerequisite: Fundamentals of Machine Tool A - 470913</i> <i>Fundamentals of Machine Tool B - 470914</i></p>
Content/Process
<p>Students will:</p> <ol style="list-style-type: none"> 1. Practice and perform safe shop procedures at all times. 2. Apply the technical math required for employment opportunities in machining. 3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork. 4. Machine and finish holes on the milling machine. 5. Cut and finish different types of key seats. 6. Select and use different types of milling cutters. 7. Select and perform basic grinding operation. 8. Machine holes on a vertical mill. 9. Form mill on a vertical mill. 10. Mill key seats. 11. Mill an angle on a vertical mill. 12. Cut and finish holes on the milling machine. 13. Demonstrate the care and safe use of machine grinders. 14. Select grinding wheels. 15. Classify metals and metal shapes.
Connections
<ul style="list-style-type: none"> • Common Core Standards • Common Core Technical Standards • New Generation Science Standards • (NIMS) National Institute for Metalworking Skills • MasterCAM • KCTCS Course: CAD 120 • CTSO - SkillsUSA • KOSSA

Applied Machining - II

Valid Course Code: 470912

Course Description: Prepares the student for a higher level in the operation of machine tools. Applications in milling, lathe, bench work, and utilizing gauge blocks and the sine bar are covered in this course. Surface grinding and abrasives are introduced, and properties of metals are discussed.

Prerequisite: Applied Machining I - 470911

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Perform the grinding of parts with surfaces that are flat, parallel, and perpendicular.
5. Perform the machining of tapers on mills and lathes.
6. Perform plunge cutting operations.
7. Perform the knurling on the lathe.
8. Operate a surface grinder.
9. Mount, balance, and dress grinding wheels.
10. Cut tapers.
11. Perform plunge cut operations.
12. Chase standard threads on the lathe.
13. Chase metric threads on the lathe.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CAD 122
- CTSO - SkillsUSA
- KOSSA

Blueprint Reading for Machinist
Valid Course Code: 470921

Course Description: Provides the student with a beginning and advanced series of lectures, demonstrations, and practice exercise in the study of prints. Safety will be emphasized as an integral part of this course.

Prerequisites: Consent of Instructor

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Demonstrate competency in mathematical fraction and decimal problems.
5. Identify the alphabet of lines.
6. Identify multiple views.
7. Arrange multiple views.
8. Arrange two view drawings.
9. Identify one view drawings.
10. Arrange and identify auxiliary views.
11. Demonstrate the use of size and location dimensions.
12. Demonstrate proper dimensions of cylinders and arcs.
13. Size dimensions of holes and angles.
14. Locate dimensions for centering of holes, points, and centers.
15. Interpret the base line dimensions on drawings.
16. Calculate tolerances.
17. Identify labeling of various screw threads.
18. Calculate tapers and machined surfaces.
19. Dimension parts using shop notes.
20. Identify half, full, and removed sections.
21. Interpret ordinate and tabular dimensions.
22. Set tolerances using geometric dimensioning techniques.
23. Sketch parts with irregular shapes.
24. Sketch oblique views of various parts.
25. Sketch and dimension shop drawings.
26. Demonstrate visualizing techniques of multiple views.
27. Identify line types used in combinations.
28. Identify standards listings on working drawings.
29. List procedural machining and construction requirements from notations on working drawings.
30. List proper procedure for construction of various machining processes.
31. Determine proper thread series and types for duty specific assembly.
32. Specify duty specific uses of contour notes.
33. Determine overall measurements of contoured parts.
34. Explain various terms involved in multiple sections.
35. Identify usages for chamfers and interpret sizes.

36. Define various chamfer terms.
37. Determine the sizing procedures of necks and grooves.
38. Identify various keyway and key seat standards.
39. Identify usage of geometric symbols.
40. Define terms relating to geometric tolerance.
41. Set standards and tolerances using geometric dimensioning.
42. Set axis coordinates on numerical control prints.
43. Determine axis coordinates on ordinate and tabular prints.
44. Identify casting and forging terms.
45. Calculate bend setbacks in sheet metals and plate steels.
46. Identify parts and materials from various reference books and manuals.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: BRX 112
- CTSO - SkillsUSA
- KOSSA

CAD/CAM/CNC
Valid Course Code: 470925

Course Description: This course introduces the student to CAD/CAM/CNC systems which includes CAM software. The student will utilize process planning, manual programming and CAD/CAM for CNC equipment. The student will load a CNC program and set tool and work offsets, and machine part.

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Perform routine maintenance on tools, equipment, and machines.
5. Demonstrate knowledge of manual data input on CNC machines.
6. Create a roughing tool path for milling applications.
7. Enter tool offsets and cutter geometry and work offset.
8. Test and run a program.
9. Create a thread element, grooving and roughing for turning.
10. Use fixed cycles on CNC machines.
11. Use an automatic tool changer.
12. Work with sub-routines.
13. Generate code from converted CAD geometry.
14. Use the CAM system to transfer CAD geometry, RS - 232, DNC link.
15. Use process planning for CNC equipment.
16. Create drawings on CAM software.
17. Load a CNC program and set tool and work offsets.
18. Generate code using CAM software.
19. Operate CNC equipment.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CMM 132
- CTSO - SkillsUSA
- KOSSA

Conversational Editing and Subroutines

Valid Course Code: 470927

Course Description: Introduces students to performing editing routines, to subroutines, and to programs that contain loops. Students will also interpret error messages from the control.

Prerequisite: Introduction to Conversational Programming - 470926

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Preventative measures.
5. Hazardous materials.
6. Safe use of CNC milling machines.
7. Use conversational programming of CNC machine tools.
8. Complete projects using the skills obtained in the classroom in work situations.
9. Write a conversational program.
10. Troubleshoot the program and correct mistakes.
11. Identification of errors and correction of them in programs.
12. Improvement of programs.
13. Writing programs by hand.
14. Performance of machining operations using programs written by hand.
15. Editing of existing programs.
16. Edit existing blocks in programs.
17. Interpret error messages from the control.
18. Demonstrate knowledge of when to use and when not to use polar coordinates.
19. Calculate X, Y or Z and I, J, or K points using the Pythagorean Theorem and trigonometry.
20. Write a program containing subroutines.
21. Write a program containing loops.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CMM 2302
- CTSO - SkillsUSA
- KOSSA

Co-op (Machine Tool)
Valid Course Code: 470929

Course Description: Cooperative education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the cooperative education program receive compensation for their work. This course can be repeated.

Prerequisite: Consent of Instructor

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Gain career awareness and the opportunity to test career choice(s).
5. Receive work experience related to career interests prior to graduation.
6. Integrate classroom studies with work experience.
7. Receive exposure to facilities and equipment unavailable in a classroom setting.
8. Increase employability potential after graduation.
9. Earn funds to help finance education expenses.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CMM 299
- CTSO - SkillsUSA
- KOSSA

Fundamentals of Machine Tools - A

Valid Course Code: 470913

Course Description: This course provides the basic principles needed for a solid foundation in machine tool technology. Areas and machines covered include shop safety, bench work, drill press, power saw, measurement, mills, and lathes.

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Perform bench work processes, hacksaw, files, layout, drill, tap and other activities to meet industry standards.
5. Perform safe and functional activities on the following machines: horizontal band saw, vertical band saw, drill press, arbor press, lathes, and mills.
6. Perform tasks with cutting hand tools and non-cutting hand tools.
7. Identify and explain the handling procedure for hazardous material and the MSDS.
8. Identify safety needs and regulations in a machine shop.
9. Identify non-cutting hand tools and the proper use of them.
10. Prepare for a bench work process.
11. Hand saw with a hacksaw.
12. Bench file the work piece.
13. Dress and true grinding wheels on bench and pedestal grinders.
14. Demonstrate knowledge of power saws, parts, and applications.
15. Demonstrate the care and safe use of the power saw.
16. Cut and weld band saw blades.
17. Perform operations on the cut-off saw.
18. Perform operations on the vertical band saw,
19. Demonstrate knowledge of drill press, parts, and applications.
20. Demonstrate the care and safe use of the drill press.
21. Calculate and set the cutting speed and feed on the drill press.
22. Sharpen drills.
23. Set up a drill press and drill holes.
24. Shape and finish holes on a drill press.
25. Tap holes by hand and machine on a drill press.
26. Thread by hand with taps and dies.
27. Operate an arbor press.
28. Use chisels and punches.
29. Demonstrate knowledge of hazardous materials handling.
30. Demonstrate knowledge of hazardous materials storage.
31. Demonstrate lock-out/tag-out procedures.
32. Demonstrate use of MSDS.
33. Measure with basic hand-held measuring instrument.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CMM 110
- CTSO - SkillsUSA
- KOSSA

Fundamentals of Machine Tools - B

Valid Course Code: 470914

Course Description: This course provides intermediate skill development in machine tool technology. The course builds on basic skills especially in the calculation of safe cutting speed and feed rates for the drill press, power saw, mills, and lathes. Shop safety, bench work, and precision measurement are also emphasized.

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Demonstrate knowledge of lathes, parts, and applications.
5. Demonstrate the care and safe use of lathes.
6. Demonstrate use and knowledge of mill parts and applications.
7. Demonstrate knowledge of cutting tools.
8. Demonstrate knowledge of cutting fluids.
9. Identify and explain the handling procedure for hazardous material and the content of MSDS.
10. Calculate and set speeds and feeds on a lathe.
11. Sharpen high speed tool bits.
12. Mount work piece on a lathe.
13. Face a work piece.
14. Perform turning operations.
15. Machine with carbide cutting tools.
16. File and polish a work piece.
17. Demonstrate knowledge of a milling machine, parts, and applications.
18. Demonstrate the care and safe use of milling machines.
19. Calculate and set speeds and feeds on the milling machine.
20. Mill flat surfaces and grooves using a vertical mill.
21. Apply cutting fluid to machining operations.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CMM 112
- CTSO - SkillsUSA
- KOSSA

Interdisciplinary Geometry and Computer Aided Drafting (CAD)
Valid Course Code: 480114

Course Description: This course is designed to introduce the student to the customization of the CAD software. Menu creation and programming will be applied as it relates to the CAD program.

Prerequisites: Introduction to Computer Aided Drafting - 480110

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on Integrity, responsibility, quality, discipline and teamwork.
4. Utilize advanced CAD applications.
5. Develop basic programming techniques.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- CTSO - SkillsUSA
- KOSSA

Internship (CMM)
Valid Course Code: 470932

Course Description: Internship provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Internship do not receive compensation.

Prerequisites: Permission of the Instructor

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Gain career awareness and the opportunity to test career choice(s).
5. Receive work experience related to career interests prior to graduation.
6. Integrate classroom studies with work experience.
7. Receive exposure to facilities and equipment unavailable in a classroom setting.
8. Increase employability potential after graduation.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CMM 298
- CTSO - SkillsUSA
- KOSSA

Intermediate Computer Aided Drafting

Valid Course Code: 480112

Course Description: Uses CAD software to produce advanced two-and three-dimensional object drawings. Practices advanced techniques of drafting, layering, and symbols associated with one or more design applications. Calculates perimeters, areas, and mass associated with the drawings.

Prerequisite: Intro to Computer Aided Drafting - 480110

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Demonstrate, through practice and communications, a comprehensive working knowledge of CAD drafting and the drafting symbols associated with one or more design applications.
5. Produce complex drawings through use of CAD techniques.
6. Use CAD to calculate perimeters and areas for design features.
7. Construct three-dimensional models using various techniques.
8. Project two-dimensional orthographic and axonometric views and sections off of the three-dimensional models.
9. Use advanced CAD operations.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CAD 200
- CTSO - SkillsUSA
- KOSSA

Introduction to Computer Aided Drafting

Valid Course Code: 480110

Course Description: Uses computer graphic workstation in the application of fundamental principles and capabilities of CAD, basic drafting conventions, and operations. Students participate in an in-depth study of computer aided drafting commands, terminology, command utilization, and skill development.

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Demonstrate an understanding of orthographic projection, section, auxiliary, and pictorial views as they relate to three-dimensional objects.
5. Identify the alphabet of lines and name each lines' use.
6. Use architect's metric, civil, mechanical drafter's scales.
7. Understand the use and purpose of a title block.
8. Demonstrate a basic understanding of dimensions and their uses.
9. Describe, using correct computer terminology, basic computer functions, uses of computers in society and different types of software.
10. Discuss ethical computing issues, such as copyright, privacy, security, and property.
11. Use graphical user interface.
12. Use computer application programs.
13. Access information sources found on networks such as the Internet and be familiar with Web browsers and search for information related to his or her own field.
14. Demonstrate an awareness of different types of software applications.
15. Produce line entities using various coordinate techniques.
16. Construct geometric shapes in two-dimensional space.
17. Develop detailed orthographic views as required.
18. Construct cross sections of various designs, with cross-hatching incorporated as desired.
19. Apply dimensions and annotations to drawings.
20. Move, copy, delete, and save drawings or portions of drawings.
21. Use CAD to manipulate drawings by means of translation, rotation, scaling, zooming, panning, and windowing.
22. Explore 3-D drawing techniques.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CAD 100
- CTSO - SkillsUSA
- KOSSA

Introduction to Conversational Programming

Valid Course Code: 470926

Course Description: Introduce students to conversational programming guidelines, which will include program preparation, conversational input, and minor editing.

*Prerequisites: Fundamentals of Machine Tools - A 470913
Fundamentals of Machine Tools - B 470914*

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Preventative measures.
5. Hazardous materials.
6. Safe use of CNC milling machines.
7. Use conversational programming of CNC machine tools.
8. Complete projects using the skills obtained in the classroom in work situations.
9. Write a conversational program.
10. Troubleshoot the program and correct mistakes.
11. Response to prompts.
12. Preparation of a conversational program.
13. Edit of existing conversational programs.
14. Performance of machining operations using programs created by student.
15. Respond to prompts correctly to build a program.
16. Prepare a program in conversational language.
17. Compare conversational input to coded input.
18. Determine errors in programs and correct them.
19. Look for improvements in the process of a program.
20. Insert blocks of information into programs.
21. Delete blocks of information from programs.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CAD 2301
- CTSO - Skills USA
- KOSSA

Manual Programming

Valid Course Code: 470915

Course Description: This course introduces the student to CNC format and the Cartesian Coordinate System. It also introduces the student to CNC codes and programming, set-up, and operation of CNC machine tools. The student will utilize process planning and manual programming for CNC equipment. The student will load a CNC program and set tool and work offsets.

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Use process planning for CNC equipment.
5. Use manual programming for CNC equipment.
6. Load a CNC program and set tool and work offsets.
7. Identify the tasks that must be done to put a job into production.
8. Use proper tool path sequencing.
9. Apply the "Rule of Thumb" to determine rotary axis direction and the "Right-Hand Rule".
10. Describe the characteristics and differences between position and reference points.
11. Calculate coordinate points using absolute Cartesian values.
12. Calculate coordinate points using incremental Cartesian values.
13. Identify basic CNC code structure.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: CAD 130
- CTSO - SkillsUSA
- KOSSA

Mechanical Blueprint Reading

Valid Course Code: 470922

Course Description: Provides the student with an advanced series of lectures, demonstrations, and practice exercises in the study of prints involving math (both decimal and metric), combination of lines, multi-view drawings, assembly drawings, fasteners, machining and construction processes, datum coordinates, numerical control prints, sheet metal prints, welding, casting and forging prints. Safety will be emphasized.

Prerequisite: Blueprint Reading for Machinists - 470921

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Demonstrate visualizing techniques of multiple views.
5. Identify line types used in combinations.
6. Identify standards listings on working drawings.
7. List procedural machining and construction requirements from notations on working drawings.
8. List proper procedure for construction of various machining processes.
9. Determine proper thread series and types for duty specific assembly.
10. Specify duty specific uses of contour notes.
11. Determine overall measurements of contoured parts.
12. Explain various terms involved in multiple sections.
13. Identify usages for chamfers and interpret sizes.
14. Define various chamfer terms.
15. Determine the sizing procedures of necks and grooves.
16. Identify various keyway and key seat standards.
17. Identify usage of geometric symbols.
18. Define terms relating to geometric tolerance.
19. Set standards and tolerances using geometric dimensioning.
20. Set axis coordinates on numerical control prints.
21. Determine axis coordinates on ordinate and tabular prints.
22. Identify casting and forging terms.
23. Calculate bend setbacks in sheet metals and plate steels.
24. Identify parts and materials from various reference books and manuals.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: BRX 210
- CTSO - SkillsUSA
- KOSSA

Metrology/Control Charts
Valid Course Code: 470928

Course Description: Provides the basic principles in using precision measurement instruments and their application to inspection and quality control.
Content/Process
Students will: <ol style="list-style-type: none">1. Practice and perform safe shop procedures at all times.2. Apply the technical math required for employment opportunities in machining.3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.4. Demonstrate and practice correct use of gauging equipment.5. Demonstrate use of gauging equipment in part inspection.6. Demonstrate knowledge of common control chart information.7. Use gauging equipment to supply control charts with chart information.8. Discuss Coordinate Measuring Machine.9. Demonstrate and practice correct use of optical comparator.10. Demonstrate knowledge, skills and abilities of applied statistics as outlined in the NIMS Framework for Machining Skills.11. Identify parts and materials from various reference books and manuals.
Connections
<ul style="list-style-type: none">• Common Core Standards• Common Core Technical Standards• New Generation Science Standards• (NIMS) National Institute for Metalworking Skills• MasterCAM• KCTCS Course: CMM 118• CTSO - SkillsUSA• KOSSA

Special Problems (CMM)
Valid Course Code: 470979

Course Description: This is a course designed for the student who has demonstrated specific needs.

Prerequisites: Permission of Instructor

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Complete selected tasks/problems as determined by the instructor.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: IEX 291
- CTSO - SkillsUSA
- KOSSA

Technical Mathematics

Valid Course Code: 270643

Course Description: Concepts that will allow student to become proficient in the mathematics used in technical fields are the focal point of this course. Topics include manipulations of whole numbers, integers, fractions and decimals; measurement systems; an introduction to simple geometric figures; algebraic expressions; linear and quadratic equations; and solving right and oblique triangles using fundamentals of trigonometry.

Prerequisites: Permission of Instructor

Content/Process

Students will:

1. Practice and perform safe shop procedures at all times.
2. Apply the technical math required for employment opportunities in machining.
3. Perform all duties with emphasis on integrity, responsibility, quality, discipline and teamwork.
4. Perform conversions using U. S. customary and SI (metric) measures.
5. Apply basic plane geometric principles of lines, angles, triangles and other polygons, circles and arcs, congruency and similarity.
6. Calculate surface area and volume of basic geometric solids.
7. Solve problems involving significant digits and accuracy and precision of numbers.
8. Solve problems involving ratio, proportion, direct, inverse and joint variation.
9. Perform conversions between coordinate systems.
10. Apply fundamentals of trigonometric functions and co-functions to right triangles.
11. Apply the law of sines and the law of cosines to oblique triangles.
12. Solve problems involving compound angles.
13. Identify the vector concept, the components of vectors and add vectors.
14. Use a scientific calculator.
15. Problem solving involving the above competencies.

Connections

- Common Core Standards
- Common Core Technical Standards
- New Generation Science Standards
- (NIMS) National Institute for Metalworking Skills
- MasterCAM
- KCTCS Course: MAT 116
- CTSO - SkillsUSA
- KOSSA